Tensor-Force Effects and a New $\mathcal{N}$-$\mathcal{N}$ Separable Potential in the 3-$\mathcal{N}$ System.

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The considerable amount of work already done in connection with the three-nucleon problem allows us to assert that the low-energy properties of this system can be reasonably well described using separable two-body interactions (1).

Recently, TABAKIN (2) has suggested the possibility of describing a long-range attraction together with a short-range repulsion using only a rank-one separable potential. This type of interaction has already been tested in the three-nucleon system (3). The main conclusion of the previous calculation is that the Tabakin potential when used in the $^1S_0$ state can give as good a description of the 3-$\mathcal{N}$ low-energy parameters as the other based on rank-two separable interactions. The purpose of this note is to report the results of a calculation of the ^{3}H low-energy parameters, now including a more realistic potential for the $^3S_1$ state, taking into account the effects of tensor forces (4), while keeping the Tabakin interaction for the $^1S_0$ state (5).

Our present results are obtained by solving numerically the well-known Faddeev-Lovelace equations. We find for the tritium binding energy $E_B = -7.33$ MeV and for the doublet $\mathcal{N}$-d scattering length $a_{\frac{1}{2}} = 1.6$ fm. These values must be compared with the experimental ones, $E_B = -8.48$ MeV and $a_{\frac{1}{2}} = (0.11 \pm 0.07)$ fm, respectively.

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(1) See, for example, A. N. MITRA: *The nuclear three-body problem*, published in *Advances in Nuclear Physics*, Vol. **3** (1969).
(2) F. TABAKIN: *Phys. Rev.*, **174**, 1208 (1968).
(3) V. A. ALESSANDRINI and C. A. GARCÍA CANAL: *Nucl. Phys.*, **133** A, 590 (1969).
(4) The form factors and parameters are those appearing in Yamaguchi's paper: *Phys. Rev.*, **95**, 1635 (1954).
(5) We use the parameters given by TABAKIN (ref. (2)).

The computed value of the binding energy is in fairly good agreement with the experimental value; however, we find a gross disagreement in the doublet scattering length.

From the present results we can extract some interesting conclusions. We note a decrease in the ^{3}H binding energy ([6]), which has an effect opposite to that observed by SCHRENK and MITRA ([7]) in the 3-$\mathcal{N}$ system and by ALESSANDRINI *et al.* ([8]) in ^{6}Li treated as a three-body system. This shows the strong model dependence of the low-energy parameters of three-body systems studied via the Faddeev-Lovelace equations. With respect to the scattering length, we find a much larger value than the experimental one, but always with the correct sign. Here also, the model dependence is very strong, as should be expected.

The different behaviour of the Tabakin potential and that of rank-two separable interactions should be traced back to the off-energy-shell behaviour of the corresponding two-body T-matrices. Perhaps the new rank-one separable potential including short-range repulsion is not as appropriate as those based on two terms, one attractive and one repulsive.

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([6]) Results of ref. ([3]) should read $E_B = -7.86$ MeV and $a_{\frac{1}{2}} = 1.14$ fm. We thank the authors for pointing out to us a numerical error in the published results.

([7]) G. L. SCHRENK and A. N. MITRA: *Phys. Rev. Lett.*, **19**, 530 (1967).

([8]) V. A. ALESSANDRINI, D. AVALOS, L. EPELE, H. FANCHIOTTI, C. GARCÍA CANAL and M. GREGORIO: *Phys. Lett.*, **29** B, 83 (1968).